

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

see form PCT/ISA/220

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing

(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION

See paragraph 2 below

International application No.
PCT/US2004/015411

International filing date (day/month/year)
17.05.2004

Priority date (day/month/year)
19.05.2003

International Patent Classification (IPC) or both national classification and IPC
G02F1/1337

Applicant
KENT STATE UNIVERSITY

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☒ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITYInternational application No.
PCT/US2004/015411

JC20 Rec'd PCT/PTO 1 4 OCT 2003

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
 - ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ in written format
 - ☐ in computer readable form
 - c. time of filing/furnishing:
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in computer readable form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2004/015411

Box No. II Priority

1. ☒ The following document has not been furnished:

☒ copy of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(a)).

☐ translation of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(b)).

Consequently it has not been possible to consider the validity of the priority claim. This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

2. ☐ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43*bis*.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	2-50
	No: Claims	1
Inventive step (IS)	Yes: Claims	8,30
	No: Claims	2-7,9-29,31-50
Industrial applicability (IA)	Yes: Claims	1-50
	No: Claims	

2. Citations and explanations

see separate sheet

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING
AUTHORITY (SEPARATE SHEET)**

PCT/US2004/015411

Cited Documents

D1: JP07056172;
D4: US5973447;
D5: US6195146;
D6: US2002186336.

Item V

- 1 The application does not meet the requirements of Article 6 PCT, because claims 4, 7, 26 and 29 are not clear.
 - 1.1 Claim 4 defines values for the azimuth angle ϕ of the alignment direction of the liquid crystals. However, a well-defined azimuth angle always needs a reference axis, which is not defined in claim 4, thereby rendering the claim unclear. Therefore, the feature does not limit the claim. A similar objection applies to claims 7, 26 and 29.
- 2 The present application does not meet the requirements of Article 33(2) PCT, because the subject-matter of claim 1 is not novel over the prior art.
 - 2.1 Document D1 discloses in Figure 3 a process for preparing an aligning substrate for liquid crystals (abstract, lines 1-4) comprising the steps of
 - a) providing an aligning substrate (101) comprising an aligning film (102); and
 - b) bombarding at least a portion of the substrate with a plasma beam (106) from a plasma source (abstract, lines 9-11) at an incident angle in the range of from greater than 0° to about 80° (about 45° ; see Figure 3) to produce an aligning direction on the aligning substrate (abstract, lines 12-13).Therefore, document D1 discloses a process having all the features of claim 1.
- 3 The present application does not meet the requirements of Article 33(3) PCT, because the subject-matter of claims 2-7, 9-29 and 31-50 does not involve an inventive step.

- 3.1 As to claims 2 and 23, it is not mentioned in D1 if the plasma beam source is a closed drift thruster. However, closed drift thrusters are well known as plasma beam sources (see e.g. D4) and would be an obvious option for a skilled person looking for an efficient plasma beam source, thereby arriving without involving an inventive step at a process having all the features of claim 2 and at a method having all the features of claim 23.

As to claim 45, in D1 the plasma beam apparently provides a planar alignment. However, homeotropic alignment, i.e. vertical alignment, is well known in the art of alignment processes using ion beam bombardment (see e.g. D6). It would therefore be an obvious option for a skilled person, who wants to attain a homeotropic alignment, to choose a liquid crystal material and an alignment film material such as in D6, thereby arriving without involving an inventive step at a method having all the features of claim 45.

The thruster of D4 is an anode layer thruster. Therefore, also claims 5, 27 and 47 do not involve an inventive step.

As to claims 3, 25 and 46, neither the current density of the plasma beam nor the ion energy are mentioned in D1. It, however, appears that a skilled person would choose similar values as for alignment processes using ion beam bombardment. D5 discloses current densities of 100 - 500 $\mu\text{A}/\text{cm}^2$ (column 4, lines 44-46) and ion energies of 25 - 200 eV (column 4, lines 29-30). Therefore, claims 3, 25 and 46 cannot be regarded as involving an inventive step.

As to claims 6, 24 and 28, the aligning film in D1 comprises polyimide (abstract, lines 5-6) and thus an organic aligning composition. Therefore, also claims 6, 24, 28 and 48 are not inventive.

As to claims 4, 7, 26 and 29, the alignment in D1 apparently is a planar alignment, i.e. zenithal angle θ is about zero. Therefore, also claims 4, 7, 26 and 29 are not inventive (see item 1.1 above).

In Figure 3 of D1, the incident angle is about 45 degrees, but may also be varied slightly (paragraph [0009]) such that also claims 9, 10, 31 and 32 do not involve an inventive step.

The process of D1 further comprises a step of forming a liquid crystal cell comprising aligning substrate liquid crystals (title). It is not clear if the liquid crystals of D1 are thermotropic or lyotropic. However, both kind of liquid crystals are well known and widely used in the field of liquid crystal displays. Therefore, also claims 11, 12, 33, 34 and 49 are not inventive.

In D1, a mask (103) is used, and the plasma beam is in the form of a sheet (due to linear slit 104). Therefore, also claims 13-16 and 35-38 do not involve an inventive step.

The process of D1 further comprises a step of moving the aligning substrates through a path of the plasma beam (see arrow 107). Therefore, also claims 17-19, 39-41 and 50 are not inventive.

The distance from the aligning substrate to the plasma beam source is not indicated in D1. It, however, appears that the range of distances defined in claims 20-22 and 42-44 (5 - 50 cm) is within the normal range of distances a skilled person would choose. Therefore, also claims 20-22 and 42-44 cannot be regarded as involving an inventive step.

- 4 Claims 8 and 30 define a particular current density in the range of from 0.5 to 30 $\mu\text{A}/\text{cm}^2$ which is considerably below the lowest value found for ion beam bombardments (D5: 100 $\mu\text{A}/\text{cm}^2$) such that a skilled person would not consider those low current densities. Therefore, claims 8 and 30 appear to be novel and inventive with regard to the available prior art.
- 5 The industrial applicability of claims 1-50 is self-evident.
- 6 The independent claims are not in the two-part form (Rule 6.3(b) PCT). Closest prior art D1 is not acknowledged in the description (Rule 5.1(a)(ii) PCT). Furthermore, reference signs to the Figures are missing in the claims (Rule 6.2(b) PCT).